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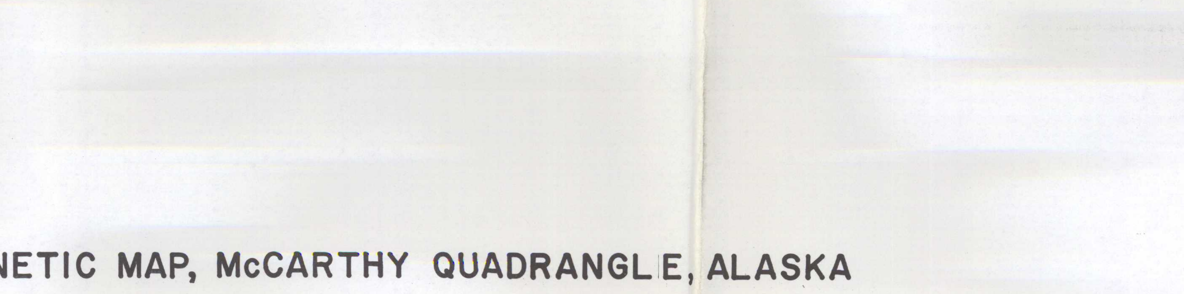
FOLIO OF THE McCARTHY QUADRANGLE, ALASKA
MAP MF-773D
SHEET 2 OF 2
CASE AND MacKEVETT– GEOLOGIC INTERPRETATION OF AEROMAGNETIC MAP

Base by U.S. Geological Survey, 1967

Background information relating to this map is published as U.S. Geological Survey Circular 739, available free of charge from the U.S. Geological Survey, Reston, Va. 22092

SCALE 1:250 000

CONTOUR INTERVAL 200 FEET
DATUM IS MEAN SEA LEVEL



QUADRANGLE LOCATION

GEOLOGIC INTERPRETATION OF AEROMAGNETIC MAP

BY

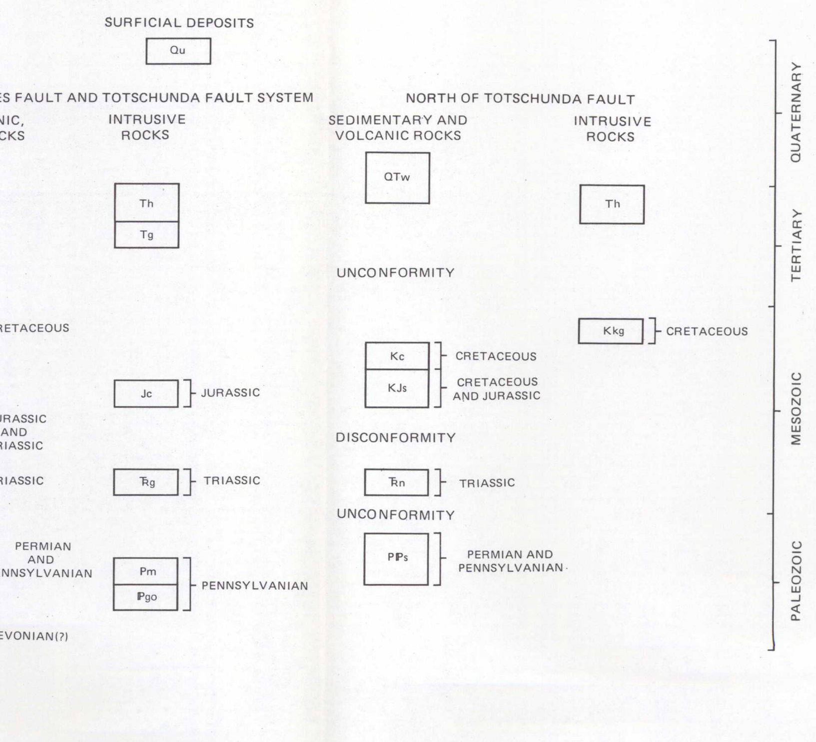
J.E. Case and E.M. MacKevett, Jr.

1976

AEROMAGNETIC MAP AND GEOLOGIC INTERPRETATION OF AEROMAGNETIC MAP, McCARTHY QUADRANGLE, ALASKA

EXPLANATION FOR GENERALIZED GEOLOGIC MAP
(GEOLOGY GENERALIZED FROM MacKEVETT, 1976)

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Qu — UNCONSOLIDATED SEDIMENTARY DEPOSITS (Quaternary)

SOUTH OF BORDER RANGES FAULT

METAMORPHIC ROCKS

KJv — VALDEZ GROUP (Cretaceous and Jurassic?)

INTRUSIVE ROCKS

Ti — INTRUSIVE ROCKS (Eocene?) Typically, foliated granodiorite and tonalite

BETWEEN BORDER RANGES FAULT AND TOTSCHUNDA FAULT SYSTEM

SEDIMENTARY, VOLCANIC, AND METAMORPHIC ROCKS

QTw — WRANGELL LAVA (Quaternary and Tertiary) Chiefly subaerial andesitic lava flows and tephra; includes local subaerial sedimentary rocks of the Frederika Formation

K — MARINE SEDIMENTARY ROCKS (Upper and Lower Cretaceous) Includes MacColl Ridge, Chititu, Moonshine Creek, Schulze, and Kennicott Formations, and unnamed Lower Cretaceous rocks

JTR — MARINE SEDIMENTARY ROCKS (Jurassic and Triassic) Includes Root Glacier, Nizina Mountain, Lubbe Creek, and McCarthy Formations, Kotsina Conglomerate, and Nizina and Chitistone Limestones

TRn — NIKOLAI GREENSTONE (Upper and (or) Middle Triassic) Mainly subaerial tholeiitic basalt; includes subordinate Chitistone Limestone north of Totschunda fault system

PIPs — SKOLAI GROUP (Permian and Pennsylvanian) As mapped includes a few scattered remnants of Middle Triassic sedimentary rocks in northeastern part of quadrangle

PIPsm — METAMORPHOSED SKOLAI GROUP (Permian and Pennsylvanian) Includes a few small outcrops of serpentinized ultramafic rocks near Border Ranges fault

Pzk — KASKAWULSH GROUP OF KINDLE (1953) (Devonian?)

INTRUSIVE ROCKS

Th — FELSIC HYPABYSSAL ROCKS (Pliocene) Mainly porphyritic dacite

Tg — GRANODIORITE (Pliocene) Unfoliated granodiorite with local mafic border facies

Jc — CHITINA VALLEY BATHOLITH (Jurassic) Mainly foliated quartz monzodiorite, granodiorite, and tonalite

TRg — GABBRO

IPm — MONZONITIC-GRANITIC COMPLEX (Pennsylvanian) Mainly nonfoliated quartz monzonite and granite, local mafic border facies

IPgo — GABBRO AND ORTHOGNEISS (Pennsylvanian)

NORTH OF TOTSCHUNDA FAULT SYSTEM

SEDIMENTARY AND VOLCANIC ROCKS

QTw — WRANGELL LAVA See above

Kc — CHISANA FORMATION (Lower Cretaceous) Marine and subaerial volcaniclastic and volcanic rocks

KJs — NUTZOTIN MOUNTAINS SEQUENCE (Lower Cretaceous and Upper Jurassic)

TRn — NIKOLAI GREENSTONE See above

PIPs — SKOLAI GROUP See above

INTRUSIVE ROCKS

Th — FELSIC HYPABYSSAL ROCKS See above

Kkg — KLEIN CREEK PLUTON (Cretaceous) Chiefly granodiorite

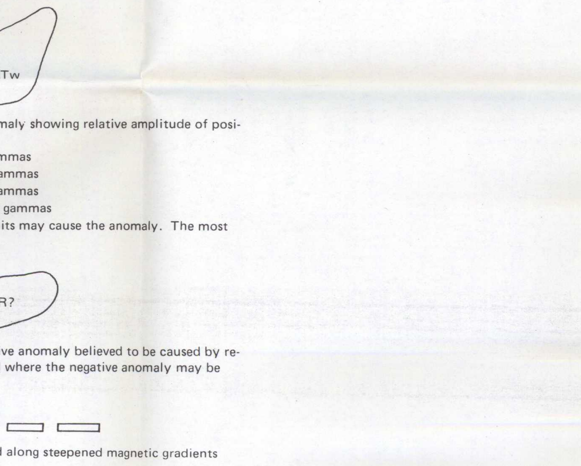
Contact; dotted where concealed

High-angle fault; dotted where concealed

Thrust fault; sawteeth on upper plate. Dotted where concealed

NOTE: Areas without letter symbols are glaciers and snowfields

EXPLANATION FOR GEOLOGIC INTERPRETATION OF AEROMAGNETIC MAP



DISCUSSION

TABLE 1.--Magnetic properties of rocks from the McCarthy quadrangle

Magnetic expression of major rock units

Specific anomalies over major rock units

upper plate of the west-dipping thrust. It is also possible that the low is caused by hydrothermal alteration of magnetite in the monzonitic-granitic rocks. The large magnetic high in the SE¼ Tp. 9 S., R. 23 E. may be a composite high caused by both the Kaskawulsh Group of Kindle (1953) (Pzk) and monzonitic-granitic rocks.

IPgo - Gabbro and orthogneiss in the west-central part of the quadrangle are moderately to strongly magnetic. The conspicuous, complex magnetic high in Tps. 5 and 6 S., Rs. 10-12 E. is clearly correlative with this rock unit. From the large amplitude and proximity to the exposed gabbro, one may infer that the anomalies along the line between Tps. 5 and 6 S., Rs. 8-11 E., near the area where the Chitina River leaves the quadrangle, are likewise caused by gabbroic masses concealed beneath the surficial cover. Magnetic highs in Tps. 6 and 7 S., R. 19 E. may be caused by gabbroic bodies.

Pzk - In the southeastern part of the quadrangle, the Kaskawulsh Group of Kindle (1953), of marble, schist, phyllite, and minor amphibolite, is surprisingly magnetic in places. Several positive anomalies of a few hundred gammas correlate well with topographic highs over the unit, especially in Tps. 5-9 S., Rs. 22-24 E. Several conspicuous north-trending magnetic lineaments occur within and adjacent to the Kaskawulsh terrane. One of the westerly lineaments locally coincides with a west-dipping reverse (or thrust) fault zone. A program of sample collection and ground magnetic surveys of the Kaskawulsh at the sites of the magnetic highs should aid in determining if the source of these anomalies lies at greater depth.

Magnetic lineaments

The most conspicuous magnetic lineament in the McCarthy quadrangle is the Totschunda lineament, which trends northwest in the northeast quarter of the quadrangle. The magnetic lineament has been placed along the zone of steepened magnetic gradient. It lies closely parallel to the mapped traces of the Totschunda fault but appears to be offset 2 km or more to the southwest of the fault in the northern part, crosses the fault in T. 3 S., R. 22 E., and lies northeast of the fault on the east border of the quadrangle. An elongate magnetic low lies southwest of the lineament shown on sheet 2. The cause of this low is most uncertain. In general it does not correlate with low topography. As it coincides with either the Nikolai Greenstone or Wrangell Lava, it may represent a reversed remanent zone that fortuitously parallels the fault. Perhaps more likely is that the Totschunda zone is quite wide, and that milling and alteration in the fault zone have caused a loss of magnetization. In either event, the cause of the low should be investigated further by detailed sampling programs and, perhaps, by ground magnetic profiles.

Griscom (1975) has shown that 20-25 km of right-lateral offset across the Totschunda fault is consistent with the geologic and magnetic data in the Nabesna quadrangle to the north. In the McCarthy quadrangle, the geologic relations across the fault permit such an interpretation, but the magnetic patterns are inconclusive.

In the southeast quarter of the map, two magnetic lineaments trend northerly in Tps. 6-9 S., Rs. 21 and 22 E. The western lineament coincides closely with a north-trending segment of a reverse fault but diverges from the mapped fault in Tps. 6 and 7 S. An unmapped fault in the Kaskawulsh terrane may be postulated along the eastern lineament.

Several magnetic lineaments trend northwest across the central and southwest parts of the quadrangle. In the extreme southwest, the Border Ranges fault zone may be the cause of a rather inconspicuous zone of steepened magnetic gradient. The steepened gradient coincides with or occurs a few kilometers south of the mapped trace of the fault. If this magnetic lineament is, indeed, caused by the Border Ranges fault, the fault zone may be wider than shown on the generalized geologic map or the fault may have a southward dip in Rs. 12-14 E. The presence of a Tertiary pluton of unknown magnetic properties is a complicating factor. The northwest-trending lineament near the Chitina River in the south-central part of the quadrangle seems to form an envelope to a zone of reverse faults that dip southwest. This magnetic lineament breaks into two splays near the confluence of the Chitina and Nizina Rivers. One major splay trends west-northwest as the southern envelope of the series of complex reverse faults near the Gilahina and Kuskulana Rivers. This lineament may be the boundary between major geologic provinces. The late Paleozoic Skolai terrane occurs south of the splay and outcrops of the early Mesozoic Nikolai Greenstone occur to the north of the splay. This splay also lies along a major northwest-trending gravity gradient that separates values of the Bouguer anomaly field into areas of -50 to -150 mgals to the northeast (thicker crust) from areas of -50 or more positive (thinner crust) to the southwest (Barnes, 1976). A second major splay trends westward from the major boundary in T. 6 S., Rs. 9-12 E. along the Chitina River Valley. It seems to form the southern boundary of a zone of Pennsylvanian gabbros.

A more poorly defined magnetic lineament trends northwest from T. 6 S., R. 16 E. to T. 1 N., R. 9 E. Tectonic significance of this lineament is obscure, but it crudely forms the northern border of a block of topographically high terrain southwest of the Nabesna and other glaciers. Some faults parallel the magnetic lineament in Tps. 4 and 5 S., Rs. 14 and 15 E., but the faults lie 3-5 km north of the steepest gradients. Along the northwestern two-thirds of its length, this lineament marks the northeast limit of the Nikolai Greenstone and a belt of Tertiary hypabyssal rocks.

A northwest-trending magnetic lineament in Tps. 4-6 S., Rs. 15-18 E. closely parallels a zone of southwestward-dipping reverse faults. This lineament may extend northwest into T. 3 S., R. 14 E. The northwestern part of the lineament marks the limit of the Nikolai Greenstone.

Lineaments in Tps. 5-7 S., Rs. 16-18 E., do not appear to coincide with mapped faults.

Conclusions

Several bedrock units are the host of known or potential ore deposits in the McCarthy quadrangle. Many of the plutonic intrusions, ranging from dioritic to granitic in composition, are the site of prospects or geochemical anomalies for several metals, especially copper, gold, silver, molybdenum, lead, and zinc. Perhaps the most significant in the northern part of the quadrangle are the plutons of the Klein Creek type, which may contain copper deposits, especially where hydrothermal alteration has occurred. Plutons of the Chitina Valley type, in the southern part of the quadrangle, where geochemical anomalies of copper and other metals occur, may also be significant. Again, alteration zones may be suspected where aeromagnetic lows are present over the plutons.

The huge composite high in T. 1 S., Rs. 23 and 24 E., northeast of the Totschunda lineament, indicates the presence of at least two large magnetic bodies at depth. The larger is at least 10 km across, and the smaller, centered in T. 1 S., R. 24 E., is at least 5 km across. A complex ring dike, perhaps mafic, may be suspected at depth.

Limestones that are host to the Kennecott type of copper deposits are not magnetic. But because they are everywhere underlain by the Nikolai Greenstone, they can be indirectly traced beneath cover of younger deposits by magnetic mapping of the concealed Nikolai. For example, the large magnetic high in T. 8 S., R. 18 E., over Cretaceous sedimentary rocks, is interpreted to be caused by Nikolai at depth. If this is a correct interpretation, there is at least a chance that the Nizina and Chitistone Limestones are likewise present at depth.

Whether a systematic relation exists between geochemical anomalies, prospects, and the major lineaments has yet to be determined. A crude parallelism exists between geochemical anomalies and the Totschunda fault zone, but this may merely reflect accidental geochemical sample points. Similarly, many prospects and geochemical anomalies occur in the band that trends northwest across the central part of the quadrangle, where several major lineaments are postulated from the magnetic data. This band, of course, is where the Nikolai Greenstone and associated sedimentary rocks are concentrated, and where Tertiary plutons and plutons of the Chitina Valley type appear to be associated with geochemical anomalies.

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